

WHAT IS CLAIMED IS:

1. A microswitch, comprising:

a substrate;

a first electrode portion fixed to the substrate  
5 and having a first contact surface, the first electrode  
portion including a first layer formed of a first  
carbon series material and provided with a group of  
first fine holes extending to reach the first contact  
surface, and first metal segments formed of a first  
10 metal material and buried in the first fine holes,  
respectively;

a second electrode portion arranged to face  
the first electrode portion with a gap provided  
therebetween and having a second contact surface  
15 movable toward the first electrode portion, the second  
electrode portion including a second layer formed of a  
second carbon series material and provided with a group  
of second fine holes each extending to reach the second  
contact surface, and second metal segments formed of  
20 a second metal material and buried in the second fine  
holes, respectively; and

a deformable structure configured to support the  
second electrode portion on the substrate to face the  
second contact surface to the first contact surface  
25 with a gap in a non-contact state, and configured to be  
deformed to shift the second electrode portion and  
contact the second contact surface with the first

contact surface in a contact state.

2. The microswitch according to claim 1, wherein the first fine hole extends through the first layer toward the first contact surface, and the second fine  
5 hole extends through the second layer toward the second contact surface.

3. The microswitch according to claim 1, wherein the substrate has a surface, the deformable structure includes a base portion fixed to the substrate and  
10 a movable portion extending from the base portion along the surface of the substrate with a second gap, and the second electrode portion is fixed to the movable portion.

4. The microswitch according to claim 3, wherein  
15 the first fine hole extends through the first layer toward the first contact surface, and the second fine extends through the second layer toward the second contact surface.

5. The microswitch according to claim 1, further  
20 comprising a first contact layer electrically connected to the first metal segments, and a second contact layer electrically connected to the second metal segments.

6. The microswitch according to claim 1, wherein the first layer and the first metal segment have  
25 a coincident surface on the first contact surface.

7. The microswitch according to claim 1, wherein the second layer and the second metal segments have

a coincident surface on the second contact surface.

8. The microswitch according to claim 1, wherein the first fine holes are opened on the first contact surface, and the first metal segment has an end  
5 defining recess in the corresponding first fine hole.

9. The microswitch according to claim 1, wherein the second fine holes are opened on the second contact surface, and the second metal segment has an end defining recess in the corresponding second fine hole.

10 10. The microswitch according to claim 1, wherein each of the first and second carbon series material is a material selected from the group consisting of diamond doped with an n-type or p-type impurity and graphite.

15 11. A method of manufacturing a microswitch, comprising:

forming a first electrode portion having a first  
contact surface on a substrate such that the first  
electrode portion is fixed to the substrate, the  
20 forming the first electrode portion including:

forming a first carbon series material layer  
on the substrate;

forming a first metal layer on the first  
carbon series material layer;

25 subjecting the first metal layer to an anodic  
oxidation within an acidic solution so as to form  
a first porous film in at least a surface region of

the first metal layer;

subjecting the first carbon series material layer to an anisotropic etching with the first porous film used as a mask so as to form a group of first fine  
5 holes; and

burying a first metal material in each of the first fine holes;

forming a second electrode portion positioned to face the first electrode portion with a gap, the second  
10 electrode portion having a second contact surface movable toward the first electrode portion, the forming the second electrode portion including:

forming a sacrificial layer having a pattern on the substrate;

15 forming a second carbon series material layer on the sacrificial layer and on the substrate;

forming a second metal layer on the second carbon series material layer;

20 subjecting the second metal layer to an anodic oxidation within an acidic solution so as to form a second porous film in at least a surface region of the second metal layer;

subjecting the second carbon series material layer to an anisotropic etching with the second porous  
25 film used as a mask so as to form a group of second fine holes; and

burying a second metal material in each of

the second fine holes; and

forming a deformable structure configured to support the second electrode portion on the substrate to face the second contact surface to the first contact surface with a gap in a non-contact state, and  
5 configured to be deformed to shift the second electrode portion and contact the second contact surface with the first contact surface in a contact state, the forming the deformable structure including removing the  
10 sacrificial layer.

12. The method of manufacturing a microswitch according to claim 11, wherein the metal layer is formed of one material selected substantially from the group consisting of aluminum, titanium, tantalum,  
15 copper and an alloy thereof.